



T E C H N I C A L B R I E F

Thermal Treatment of Building Decontamination Residue

EPA has unique programmatic responsibilities and expertise related to the decontamination of structures and outdoor areas and the subsequent disposal of associated materials. In this area, the EPA's National Homeland Security Research Center (NHSRC) is committed to strengthening decontamination and disposal capabilities for critical infrastructures following a terrorist incident or natural disaster. The NHSRC is helping to meet this commitment through the investigation of thermal treatments for building decontamination residues.

Background

NHSRC's Decontamination and Consequence Management Division (DCMD) is responsible for research into chemical, biological, and radiological threat agents, both in buildings and in outdoor areas. DCMD's principal research areas are detection of threats, containment of the agents, decontamination of the area, and disposal of the residual materials.

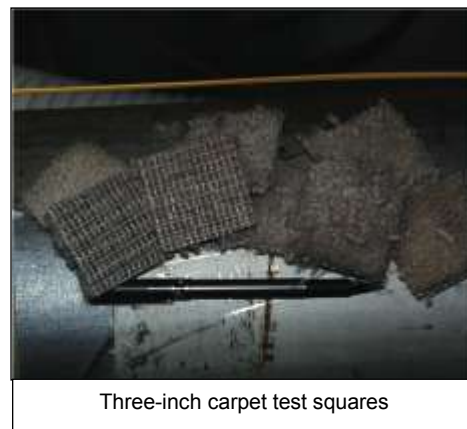
The building decontamination residues (BDRs) destined for disposal may be parts of a structure or its contents, or waste from the decontamination process. One way to deal with these BDRs is to incinerate them in combustion facilities; another is to use autoclaving with steam to disinfect them. DCMD is investigating how various materials and their contaminants behave during these two high-temperature treatments.

The Challenge

Decontamination of a building usually yields debris and waste composed of many different types of materials. Among them may be absorbents, cleaning agents, carpets, building construction materials, and air filters. Many of these items are porous, which makes it difficult to be certain that no residual contaminant is present at the end of the decontamination process. Appropriate, safe methods for disposing of large quantities of these BDRs are needed.

There are many chemical and biological (CB) threat agents that might be used to attack a building or outdoor area. These chemicals and biological organisms are quite dangerous to work with, so DCMD's experiments are frequently performed using "simulants" for the CB agents. Simulants are chemicals or organisms that behave similarly to the agent in question but are far safer to use in research. Spore-forming bacteria such as anthrax are the most difficult to destroy thermally, so DCMD research into disposal of biological agents uses anthrax simulants such as *Geobacillus stearothermophilus*, a common spore-forming soil bacterium. Any thermal process that destroys those bacteria will kill other, less hardy organisms as well.

In DCMD's experiments, samples of building materials are inoculated with simulants of CB warfare agents and then exposed to high temperatures. The scientists can then measure how various levels of heat affect the absorption, release, and destruction of the contaminating agents bound to those materials.

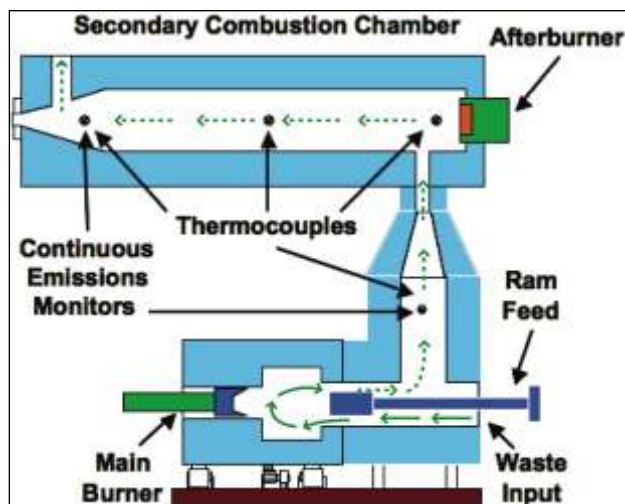


Three-inch carpet test squares

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DCMD's Research Projects

Combustion DCMD researchers want to understand both residue combustion and incinerator operations better in order to determine how combustion devices can safely be used to dispose of contaminated materials and decontamination wastes—within the existing regulatory framework. The researchers are also developing methods to sample the emissions and ash residue from combustion devices to ensure that no contamination remains.



The DCMD combustion research projects began by using a bench-scale thermal reactor to process indoor building materials, such as ceiling tiles, carpet, and wallboard, that had been inoculated with simulants for biological agents. Not surprisingly, the destruction of contaminants was directly related both to the temperature achieved and to how rapidly the material reached that temperature. Next, EPA's pilot-scale rotary kiln incinerator simulator was used to repeat the bench-scale tests on a larger scale and to assess emissions of conventional pollutants from those same materials.

DCMD is using computer simulations to scale up the results of its bench- and pilot-scale experiments in order to predict the behavior of BDRs in full-size

incineration systems. These simulations will enable DCMD to evaluate how burning various types of BDRs will affect combustion effectiveness and combustor operating conditions, and will highlight potential regulatory compliance issues.

Many of the concerns and findings related to the combustion of BDRs apply equally to situations in which those same materials (e.g., carpet) are used as auxiliary fuel for high-temperature processes such as cement kilns. DCMD is working with industry and academia to make sure that, whenever possible, the information developed in the BDR research program is also useful for evaluating the use of those same materials as fuels. Combustion facilities need to maintain compliance with applicable environmental regulations, whatever their fuel may be.

Autoclaving Autoclaving uses high pressure and steam to sterilize items such as medical equipment and waste. The effectiveness of normal autoclaving procedures on porous materials is of particular concern to DCMD; many of the BDRs are porous, might retain residual spores, and might resist disinfection in an autoclave.

DCMD researchers evaluated the destruction of *G. stearotherophilus* spores in a commercial medical-waste autoclave as a function of time and temperature. The autoclave did effectively disinfect porous BDR contaminated with spores. The operating procedures for the autoclave needed to be altered, however, either by extending the autoclave's cycle or by using several cycles in a row.



Autoclaving facility

Products Available

DCMD has published the online Disposal Decision Support Tool to provide BDR disposal guidance to responders, regulators, facility owners, and the disposal industry. It addresses various technologies for the disposal of a variety of CB agents bound on building materials. It will ultimately cover such issues as waste characterization, compliance, selection of a disposal facility, operations, and preparation of materials. Online access will be granted by NHSRC upon request.

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For more information, please visit the NHSRC Web site at www.epa.gov/nhsrc. A number of reports on the experiments described above can be found in the Decontamination area of that Web site.

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